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Food processing and agro business productivity challenge: The case of water melon in Nigeria

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Abstract

Food processing industries in Nigeria are characterised with local –local market situation with fruits and vegetable, water melon being critical. Watermelon is a local diet fruit cultivated mostly around the northern belt of Nigeria and have chains of labourer who depends on its, its chains of transportation, loading and offloading, retailing for sustainable livelihood, with little price tagged compared to imported fruits juice "chivita". This paper foresighted institutional failure, private food industry, public health, consumer protection and education as keys to unlocked water melon processing and Agri-business potential either in using plastic or steel in processing operation. The paper attributed lack of processing potential of water melon to institution and institutional bodies of food science and technology, food and nutrition, its curriculum reform, lack of industrial entrepreneurship and market reform on fruits and vegetables.

Keywords: food processing, challenge, water melon, Agribusiness

1. Introduction

In Nigeria, water melon staple fruit is important both as a money making fruit and in diets. Yet despite its importance, water melon production in the country appears to have stalled or even wasting, while imports of apples and fruits juices surged in the 2000s and continue to increase. As Nigeria urbanizes and consumers become richer and look to the convenience of processed over fresh food items, opportunities for domestic processing should increase. But concerns are mounting that Africans are meeting increasing proportions of their demand for processed foods from imports, particularly as trade policies increasingly constrain Nigeria's options to protect its domestic food processing industry. This not only puts pressure on domestic processing but on domestic agriculture, which is typified by low processing utilization and high prices (Wilkinson and Rocha 2006). The experience of water melon juice/drink or other unit produce or products in Nigeria typifies this trend, which is characterized by increasing demand for imported drinks, wine and juice over domestic fresh water melon. These troubling developments exemplify what is likely to be an increasing issue for agriculture in Nigeria and other African countries. Nigeria's agriculture sector appears to be losing out to imported processed food products, and is unable to compete because of low productivity of her processing units

Multiple Dimensions of Food Processing

The food processing industry can be characterized along a number of dimensions: processing of imported agricultural commodities for the local market (global-to-local), processing of locally grown commodities for export (local-to-global), and processing of locally grown commodities for domestic consumption (local-to-local) (Sautier et al. 2006). Whereas we find many examples of large scale global-to-local and local-to-global food processing, local-to local food processing tends to be dominated by informal sector activities that account for the bulk of informal employment and manufacturing in Nigeria. These activities include cassava processing into flour, dried cassava and starch; fish processing, including smoking; groundnut oil extraction; and milling or grinding millet, sorghum, and maize for own use, but no known record on fruits and vegetable especially water melon had been known. Documented cases of large-scale local-to-local processing tend to be less common, the key exceptions being sugar, tomato paste and water melon juice and rind (Sautier et al. 2006). "Processing which involves a commodity for which neither the fresh nor the processed product is traded significantly. In contrast, water melon fruit processing is an example of

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import substitution where the fresh agricultural produce is non tradable (because it is bulky or highly perishable) but the processed product is tradable.

Fresh t is highly perishable, particularly in West Africa where temperatures are high and access to cold storage (or often even shade in the markets) is lacking. Moreover, the varieties grown and the growing techniques used often result in a shelf life of less than a week. The trade in fresh water melon is predominantly domestic with no regional trade yet.

The Importance of Water Melon in Nigeria

Local diets fruit and Water melon is an important cash element. Over 90,000 farmers are estimated to be involved in water melon production, as are 5,000 traders and more than 300,000 individuals in the retail and wholesale sector (Robinson and Kolavalli 2010c). An estimated 25 people are involved in getting one water melon from plot to plate. These include day laborers working in the fields, haulage truckers, the men who load and unload the water melon bulbs on and off trucks, porters, and the restaurant and chop bar owners (Robinson and Kolavalli 2010c)

For local water melon processing to be competitive and viable there are three key elements to consider.

The price of imported package juice, drink fruit paste limits the amount processors can pay for fresh water melon and thus remain competitive with imports.

This limit on the price that processors can pay water melon farmers in Nigeria sets a lower limit on water melon productivity. If the cost of producing tomato in Nigeria is greater than this upper-limit price, domestic processing will not be viable unless imports are restricted. Even if farmers can supply the processors and remain profitable, the market for fresh water melon remains, so they have the option of selling in the fresh markets if the price is greater than the processor price. Although farmers and processors typically enter into agreements that fix the selling price at the start of the season, the reality in Nigeria, as in many low- and middle-income countries, is that such contracts are rarely enforceable where the plant is operational.

Institutional Failures

Even if the processors can identify farmers who could profitably supply the processors at a price that allows the processors to be internationally competitive, the price of fresh water melon in Nigeria may be rarely below threshold. Where there are no institutional processing plant like in our case, in Nigeria, smallholder farmers are not enforceable, so farmers have little incentive to honour contracts made with processors at planting time. Hence no competition.

Private Sector Food Industry

Food processing firms in Nigeria, in order to supply growing urban markets and to attain cost reducing economies of scale, will increasingly need to scale up production from semi artisanal to industrial levels. In many instances, these increases in scale imply batch sizes several orders of magnitude larger than traditional manual processing. In Southern Africa, the industrialization of sorghum beer (traditional African opaque and cloudy beers) and *mageu* (non-alcoholic fermented cereal porridge gruel) production resulted in scaling up production from 200-liter batches by village women to stainless steel cookers of

between 15,000 and 20,000 liters (Haggblade and Holzapfel 1989). In West Africa's industrialization of *gari* (a granulated, pre-cooked convenience food made from toasted cassava) production, emerging food processors have scaled up production from individual, episodic batches of one to two tons of processed roots to continuously operated industrial plants processing 50 to 60 tons of roots per day (Onyekwere et al. 1989; Nweke et al. 2002). Another uniquely African example is the development of a lager beer brewing industry based on sorghum, firstly in Nigeria starting 25 years ago (Ilori 1991), and in the past decade in

East and Southern Africa (Mackintosh and Higgins 2004). The success of this developments can be seen from local steady growth of raw material mounting pressure from small hold farms. (Anon 2012). In order to improve food and beverage safety, avoid spoilage and to ensure product quality at industrial scales, the Nigerian and African food industry will require increasing numbers of food scientists and technologists. With Africa's many indigenous fermented foods such as *gari*, sorghumbeer, *mageu*, *fufu* (cassava or yam porridge), *ogi* (a fermented starchy cereal-based beverage), and fermented dairy products such as *amazi* – increases in batch sizes will require scientific research into the biochemistry and microbiology of these fermentations in order to identify the microbial cultures driving key fermentations, optimal temperatures and pH and effective protocols for controlling pathogenic micro-organisms and ensuring food safety (Steinkraus 1989, Taylor and Emmambux 2008). Fruits and vegetables especially water melon fruits are not left out. Marketing and logistics become increasingly important as supply chains lengthen. Growth in the post-farm segments of the supply chain results in a growing share of processing, packaging, distribution and marketing in total price paid by Nigeria or African consumers. Consequently, marketing efficiency becomes critical to efficiency of the food system., growing scale of post-farm segments of the supply chain mean that efficiency in food marketing and distribution systems will become increasingly important for moderating consumer food prices. This translates into growing demand for employees with expertise in packaging, food storage, logistics, commodity price hedging and finance. Growing demand for perishable products such as fresh fruits water melon and vegetables increase demand for expertise in logistics, quality and temperature control, packaging, cold storage management, sanitary controls and monitoring of communicable bacterial diseases (Abbott 1986). Given the increasingly volatile world commodity prices, market forecasting, commodity risk management, market monitoring, storage and regional logistics platforms will all become increasingly important for Africa's food industries. Food safety, packaging and consumer taste preferences likewise govern food marketability and food safety. As a result, private food processors will increasingly require scientific expertise in food safety, food packing and sensory evaluation techniques. To meet this need, multinational food companies operating in Africa are beginning to set up regional R&D centers where food scientists and technologists develop and adapt food products to meet local requirements. A notable example of this trend is Nestlé's Food R&D Center at Abidjan, Ivory Coast (Nestlé 2010). Food processing SMMEs are the drivers of job

creation. With increasing urbanization, small scale production of all types of food products is increasing rapidly across Africa, however this change has not been seen in water melon fruit processing in Nigeria. An interesting trend is the development of convenience food products based on traditional local foodstuff, such as pearl millet (Taylor et al. 2010) where three levels of value addition are taking place: simple flour products, value added flours (nutritionally enriched and flavored) and ready-to-eat (RTE) instant porridges and infant foods. Since the small and micro enterprises are invariably run by persons with no technical training in food science and technology, food safety risks are high. Also, processing efficiency and product quality are invariably poor. These factors greatly increase the chance of business failure.

Obviously, food scientists and technologists have a critical role to play in providing technology to SMMEs especially to our perishing fruits and vegetable across Nigeria. However, reaching them and making a significant impact is challenging because of the high numbers of SMMEs and small number of food scientists and technologists, and the issue of the SMMEs having little or no money to pay for services of the food professionals.

Franchising is an excellent way of alleviating small enterprise technical and business failure. With urbanization and rising living standards, there is a huge growth in fast food franchises across Africa, particularly from companies based in South Africa. For example, Famous Brands, a South African fast food franchise company opened eighteen restaurants in other African countries in the last quarter of 2012 (How We Made in Africa 2012). However, as is well known, the widely held opinion is that most fast foods from international companies are not healthy (Igumbor and others 2012, Pretoria News 2012). Food scientists and technologists are needed not just to improve technical efficiency, product consistency and food safety standards of fast food franchise enterprises, but importantly to substantially improve the nutritional quality of the products, while at the same time adding value technology to our perishing fruits and vegetables, maintain sensory quality. As food-borne disease (FBD) is of great importance in Nigeria.

Public Health, Consumer Protection and Consumer Education

Food and nutrition are an integral part of health. Health is not merely absence of diseases but the total well-being of an individual. Future FST activities (and education) in Africa must take cognizance of the new approaches to health. "One Health" is a relatively new approach to solving complex health related challenges that has generated significant interest and gathered momentum at global, regional and national level. The "One Health" approach, seeks to appropriate total health by ensuring disciplinary, multi-sectorial and systemic approaches to the practice of health service delivery – doing things together, learning together, and shaping the future together in this increasingly "One World, One Health and One Economy".

There are multiple and varied disciplinary and professional stakeholders in appropriating One Health including FST, veterinary science, public health, wildlife health, Agriculture, nursing, among many others. Future advocacy roles for FST professionals will be geared towards measures to help curb dietary deficiencies which water

melon holds a key and nutritional disorders as well as labeling of foods, especially genetically modified foods (GMOs), trans-fats, sugars, and other food constituents that are of health concern. FST professionals through their national bodies, affiliated to the International Union of Food Science and Technology (IUFoST) can commission independent scientific statements on contemporary and emerging issues of public interest such as GMOs, the presence of acrylamide in heat processed foods, nano-structured foods and human health, role of antioxidants in human health, trans-fats and cardiovascular diseases, dietary fiber and health, HIV/AIDS and nutrition, to guide policy directions.

Core Problems and Key Opportunities

Given the tight links between the growing prevalence of processed foods and declining health status, solutions to Nigeria's emerging public health problems will require cross-disciplinary work linking FST, human nutrition and public health. A core problem at present is that very few universities present BSc Nutrition / BSc Food Science and Nutrition programs. Furthermore, there is too little extension work and training (for non-degree purposes) in the area of Food Science and Nutrition. Another core problem is that collaborative degree programs are almost completely lacking at the national, regional and international levels. Education and Research networks nationally and regionally are required to develop joint collaborative degree and research programs. There is a strong need to create opportunities for food science and nutrition educators and students to interact with other each other, nationally and regionally. Also, food science, food technology and nutrition educators need to engage with multinational companies operating in Africa to support local high-level FST and nutrition education and human resource development. The African FST professional bodies in consultation with other regional stakeholders can help address matters of curriculum development.

Graduates in FST and associated course must be adequately equipped with necessary skills and competences that will enable them to perform future roles. This puts especial premium on the curricula and delivery of course contents in tertiary educational centers as well as promotion of life-long learning.

Future skills sets that will be demanded of FST graduates include both "hard" - engineering design (plant made of plastic processing units and not steels and irons), product development, agribusiness and entrepreneurship, nanotechnology, food and the environment, sensory and behavioral sciences, chemometrics, nutrigenomics, biotechnology, proteomics and metabolomics) and "soft" – community management, critical and strategic thinking, communication, team building, organizational skills. Public policies targeting FST curricula would have the following objectives: ensure relevance of FST curricula to national development needs; foster quality in the delivery of FST curricula; foster professional probity in the practice of FST; promote curricula reviews and guidance for such reviews; stimulate foundational or pre-tertiary interest in the food sciences and choice of Food Science as a profession; promote awareness of the role and value of food in society; and foster national accreditation system or other means to assess skills outcomes.

The formal food industry can capitalize much more on this

group than is currently the case. There should be a business incentive for graduates from industry to continue with their post-graduate studies. Innovative approaches should be implemented to utilize scarce resources more effectively. Nationally and even regionally, educators should consider joint purchasing, maintenance and use of expensive equipment by different stakeholders. Equipment suppliers should also be approached for an "equipment on loan" scheme where equipment could be placed in institutions for use by students. This will not only improve the quality of their training but also expose future buyers to a supplier's equipment.

Food Science and Technology Curriculum Reform in Nigerian Universities

In order to train a new generation of FST professionals capable of taking early and pre-emptive action in bending the curve in Africa's /Nigeria Nutrition Transition, curricular reform must begin now. These efforts will involve curricula that integrate food science and technology, human nutrition and public health as well as educational systems that facilitate internships and applied research programs linking students and faculty to private sector food industry.

Food of plant origin especially fresh fruits and vegetables are priority that requires special attention for FST education, Research and training given the growing close interface between humans and plants. In response to the demand from consumers worldwide for safe food, FST education should strengthen working together with relevant professionals to reduce food-borne and food-related risks to human health due to hazards arising from animal production. At the post-graduate level, the development and implementation of joint complementary master's and doctoral programs, nationally and regionally, will not only enhance the quality of food science and nutrition education in Africa but also promote student and academic staff mobility. Fellows of the International Academy of Food Science and Technology (IAFoST) could assist food science and technology educators in Africa as follows: Providing advice on design and content of curricula; spending serious time at African universities teaching and mentoring; lobbying governments and international funding agencies; and engaging with multinational companies operating in Africa to support local high-level FST education and HR development.

Food Industry Entrepreneurship

Africa's rapidly growing demand for processed convenience foods offer significant potential for the promotion of high quality, packaged indigenous foods which cater to local tastes but which most urban food markets fail to deliver under the forces of inertia which, by default, lead to the expansion of low nutritional quality fast foods developed in the West. A proactive New generation of FST professionals can contribute to the development and marketing of tasty, profitable, inexpensive nutrient-dense packaged foods in Africa, often by building on favoured indigenous foods such as water melon fruits and rinds, pumpkin leaves, cassava leaves, sweet potato leaves and local whole grains. Coupled with agribusiness management and entrepreneurship programs, FST food

laboratories, internship programs and competitive grants can translate into food entrepreneurship incubators serving private food industries as well as local consumers.

Fresh Fruit and Vegetable Wholesale Market Reforms

Parallel increases in urban demand for fresh fruits and vegetables offer similar prospects for raising agribusiness incomes, lowering consumer costs and improving the nutritional quality of urban diets. Early investments in urban planning, zoning, road quality and urban horticulture market infrastructure and management systems could significantly improve the efficiency of urban fresh fruit and vegetable wholesale markets as well as sanitation and public health. By reducing current high losses, improved horticulture markets offer prospects for raising farm incomes, significantly lowering urban consumer prices for fresh fruit and vegetables, and increasing urban consumption of nutrient-dense horticultural products. A focus on Africa's rapidly growing secondary cities offer early opportunities for quick wins. As an important bridge to transforming agriculture as a business and an engine for economic development, food science, food technology and nutrition professionals need to integrate more in the future with the other stakeholders in the wider agricultural innovation systems, especially in the agricultural commodity value chains and manufacturing and processing end of it. Strong food science and technology professional associations are needed to act as formalized advocacy groups to engage with policy makers on key food science and technology, and nutrition issues based on sound scientific evidence. The professional associations should also advocate for formation of national and regional centres of excellence, e.g. in the form of food research institutes to provide cutting-edge application of food science and nutrition to address emerging challenges associated with the new African fruits and vegetable menace.

Conclusion

Nigeria has repeatedly tried to launch and re-launch viable large-scale fruits and vegetable processing, but its efforts have failed. Farmers are either unable to sell fruits especially water melon at prices that allow the processors to compete with imported processed fruits products, primarily from China and the European union countries, or willing to sell to the processor but no processing plants thereby making water melon fruits prices to surge sinusoidal in the fresh market. The root causes of this failure are the lack of success in increasing productivity levels and overall volumes water melon production to those that would allow domestic processors to have a reliable source of water melon at competitive prices.. Watermelon production requires a transition from the high-price/low-productivity/low-quality situation to a low price/high-productivity/high-quality equilibrium for processing to coexist with a fresh watermelon market, having the food professional and curriculum to match with industrial demand.

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